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Remark.

46. It should be observed, that, to shorten the computations, I have contented myself with taking the times of the revolutions pretty near the truth; but if the utmost exactness be required, the accurate times of the revolutions must be employed.

47. This might be a proper place to add the method of determining the perturbation of the orbit of any planet, as derived from another planet; but since this depends upon no other than the very same principles that have been made use of in this memoir, and as their application will be shewn, in its full extent, in the memoir which I am going to print, and intend myself the honour of sending to the *Royal Society*, I shall desist, that I may not run this paper to a greater length.

LIX. *A Letter to the Right Honourable
George Earl of Macclesfield, P. R. S.
concerning the ages of Homer and Hesiod.
By George Costard, M. A.*

My Lord,

Read Dec. 13,
1753.

IT seems to be an opinion pretty generally received, that Homer and Hesiod lived much about the same time. If this be true, and they did so, whatever arguments prove the age of one, will equally serve for fixing that of the other. What that age was, is indeed not at all agreed on among writers; the only thing in which they con-

K k k

spire

spire, being, I apprehend, to place both of them much earlier than they ought to have done.

Among the ancients, Velleius Paterculus(1), as now printed at least, says, that Homer lived 950 years before his time. This author dedicates his history to the consul Vinicius, who is placed in the *fasti consulares* A. V. C. 782. which is A. D. 30. So that, according to this computation, Homer must have flourished about the year before Christ 920. And with this account agrees pretty nearly the Parian marble(2).

Herodotus, according to our present copies of him, placeth Hesiod and Homer *not more* than 400 years before his time (3). Herodotus, according to A. Gel- lius (4), was 53 years old at the beginning of the Pe- loponnesian war, or the year before Christ 431. And

(1) Hic longius a temporibus belli, quod composuit, Troici, quam quidam ventur, abfuit. Nam ferme ante annos DCCCCCL floruit, intra mille natus est. *Hist. Rom. l. i. c. 5.* In the *Fasti consular.* as published by Cardinal Noris, the consuls Vinicius and Longinus are placed the year following, or A. V. C. 783.

(2) ΑΦΟΥ ΟΜΗΡΟΣ Ο ΠΟΙΗΤΗΣ ΕΦΑΝΗ ΕΤΗΡΗ ΗΔΕΛΛΔΙΙΙ ΒΑΣΙΛΕΥΟΝΤΟΣ ΑΘΗΝΩ ΙΟΓΝΗΤΟΥ. N^o 45. where see the commentators.

(3) Ησίοδον γὰρ καὶ Ὅμηρον ἡλικίῳ τετρακοσίοισι ἔτεσι δοκῶ μὲν πρεσβυτέρους γενέσθαι, καὶ ἔπλεον. Pag. 109. *Edit. Gronov.*

(4) *Noël. Attic. l. xv. c. 23.* And if Xerxes came into Greece in the year before Christ 480. as is commonly supposed, then Homer must have lived, according to Herodotus, at most, but about 400 years before that expedition. But in this Herodotus differs widely from himself, if he is the author of the *Life of Homer* commonly attributed to him. For there he says, ἀφ' ἧς Ὁμήρου ἐγένετο, ἔτεσιν ἑξακόσια εἰκοσιδύο μέχρι τῆς Περσέω διαβάσεως, *sub fin.* See Bayer in the *Act. Petropol.* vol. 3. p. 338. where he rejects this piece as spurious.

if

if to this we add 400 years, we shall have the year before Christ 831. about which time consequently, according to him, both Homer and Hesiod must have flourished.

Among the moderns, Petavius (5) places Hesiod A. P. J. 3714. or about the year before Christ 1000. and in his *Rationarium Temporum* (6) he says, that Hesiod was contemporary with him, and that this *ex ARCTURI ORTU, quem poeta iste describit, eruditi artis illius colligunt*; and in the margin refers to Longomontanus in his *Astronomia Danica* (7).

With Petavius agrees very nearly Palmerius, as cited by Dr. Hyde in his notes on Ulug Beigh (8), tho' Sir Isaac Newton (9), whose authority with some persons is decisive, tells us, that from the achronical rising of the same star it follows, that Hesiod flourished about 100 years after the death of Solomon. This again he places, in his short chronicle, in the year before Christ 979. from which, if we subtract

(5) Uranolog. l. vii. c. 5.

(6) Part I. l. i. c. 12.

(7) And in this he hath the authority of Aulus Gellius, l. xvii. c. 21. who says, 'De Homero & Hesiodo inter omnes fere scriptores constitit, ætatem eos egisse vel iisdem ferè temporibus, vel Homerum aliquanto antiquiorem; utrumque tamen ante Romam conditam vixisse, Silvii Albæ regnantibus, annis post bellum Trojanum, ut Cassius in primo annalium de Homero atque Hesiodo scriptum reliquit, plus centum atque sexaginta, ante Romam autem conditam, ut Cornelius Nepos in primo chronicorum de Homero dixit, annis circiter centum & sexaginta.' The building of Rome is commonly placed the year before Christ 752. To this add 160 years, and Homer and Hesiod will both, according to Cornelius Nepos, have lived about the year before Christ 912.

(8) Page 3.

(9) *Chronology*, p. 95.

100 years, we shall have the year before Christ 879. when, according to him, both Hesiod and Homer, if contemporaries, must have flourished. In what manner Sir Isaac Newton computed this, or whether indeed he ever computed it at all himself, is not, at least publickly, known. It is probable he only followed some one else; and therefore, without derogating in the least from his authority, or thinking it a failure in respect to the memory of the greatest man that ever lived, I shall consider a little how far the age of these poets may be determined, with any certainty, from this achronical rising of Arcturus.

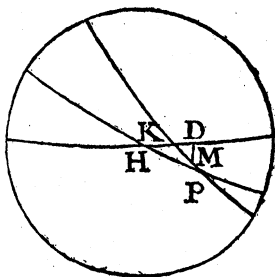
Longomontanus, in his *Astron. Danic.* (10) supposeth Hesiod to have flourished about the year before Christ 776. when he makes the place of Arcturus $\approx 12^{\circ} 16'$, the place of the Sun's apogee $8 20^{\circ} 10'$, and his place, 60 days after the winter solstice, $\approx 1^{\circ} 10'$. In the year after Christ 1610. he says, the place of Arcturus was $\approx 18^{\circ} 47'$; so that from the year before Christ 776. to the year 1610. Arcturus had moved through $36^{\circ} 31'$, $= 131460''$; which divided by 2386, the number of years elapsed, gives the annual motion of the fixed stars $55''$. But as he makes the annual motion of the fixed stars $49'' 45'''$, or 1° in $72\frac{1}{2}$ years; $55''$ will, according to him, require about 2658 years. So that Hesiod, according to his computation, must have lived about the year before Christ 1048; unless, as he seems to suspect, that poet describes the rising of Arcturus, not

(10) Lib. II. *Sphæric.* cap. iv. prob. 2.

as it was in his own time, but 272 years before. So that from hence, we see, nothing certain can be concluded with regard to his age.

Kepler, in his *Epitom. Astronom.* (11) supposeth, that from the time of Hesiod to the year after Christ 1618. are 2400 years, and that the annual motion of the fixed stars is $51''$, which, in 2400 years, gives 34° . From whence, and several other assumptions, he concludes, that, in Hesiod's time, Arcturus rose achronically March 3. in the Julian year reckoned backward, when the Sun was in $\approx 5^\circ 11'$.

Riccioli, in his *Almagest.* (12) supposeth, that Hesiod flourished about the year before Christ 775. when the place of the Sun's apogee was $8^\circ 20'$; and therefore the Sun's true motion for 60 days was $61^\circ 10'$, which added to the place of the winter solstice, or the beginning of ϖ , gives the Sun's place $\approx 1^\circ 10'$, the point opposite to that point of the ecliptic which rose along with Arcturus, or $\approx 1^\circ 10'$. Therefore, in the figure here annexed, according to him, the point K is $\approx 1^\circ 10'$, and K P the distance from the next equinoctial point, $= 28^\circ 50'$. The height of the equator at Athens, or the angle P H K, from Ptolemy's *Geography*, $= 52^\circ 15'$. He farther supposes, as Longomontanus before him, the ob-



(11) Lib. III. p. 396.

(12) Tom. I. p. 463.

liquity of the ecliptic, or the angle, HPK , $= 23^{\circ} 32'$; from whence he finds the angle $PKH = 107^{\circ} 43'$, and the complement of it $MKD = 72^{\circ} 17'$. He assumes likewise the latitude of Arcturus, or MD , $= 31^{\circ} 3'$ north; from whence he finds the arc $KM = 11^{\circ} 5'$; which added to the point K , or $\alpha 1^{\circ} 10'$, gives the place of Arcturus, or M , $= \alpha 12^{\circ} 15'$.

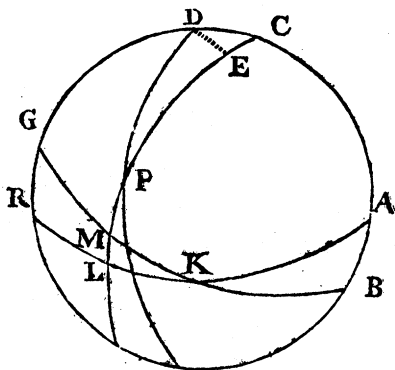
But at the end of the year 1644. the place of Arcturus, he says, was $\approx 18^{\circ} 19'$; therefore from the time of Hesiod, before assumed, to the end of the year 1644. that star had moved through $36^{\circ} 4'$. But this it would do, he says, in 2597 years. From whence, therefore, subtracting 1644, there remains the year before Christ 953. He concludes, therefore, as Longomontanus, we saw, suspected before, that Hesiod speaks of the achronical rising of this star, not as it was in his own time, but two centuries before. Besides, as the refraction of Arcturus would accelerate his rising, and the Sun's refraction would retard his setting; and as the time of the solstice was then known, at best, but in a very gross manner (13); he is of opinion, that this method is not much to be

(13) Meton and Euctemon observed the time of the solstice Olymp. LXXXVI. 4. or the year before Christ 432. and Aristarchus Samius afterwards; but Ptolemy says they were very rudely made: And that Hipparchus, before him, was of the same opinion. Ερεκεν ὃ τὸ καθόλου τὲ τὰς τῶν τροπῶν τηρήσεις δυσδιακρίτως εἶναι, καὶ πρὸς τούτοις τὰς ὑπ' ἐκείνων παραδεδομένας ὀλοχερέστερον εἰλημμένας, ὥς καὶ τῷ Ἰωπάρχῳ δοκεῖ φαίνεσθαι, ταύτας μὲν παρητησάμεθα. *Syntax.* p. 62. But if this was the case of observations then made, what must we suppose it to have been two or three hundred years before their time?

depended on ; contrary to what Scaliger (14) and Voffius (15) both thought.

As there are, however, several errors in this computation, it may not be amiss, perhaps, to form another, upon supposition, with Sir Isaac Newton, that Hesiod flourished about the year before Christ 879. or, in round numbers, the year 880. and let us see what will be the result of it.

At the end of the year 1689. the place of Arcturus, in the British catalogue, was $\approx 19^{\circ} 53' 52''$, or $6^{\circ} 19' 53' 52''$; and from the year before Christ 880. to the end of the year 1689. are 2569 years, the precession for which time is $1^{\circ} 5' 40' 50''$: This, subtracted from the place of Arcturus $6^{\circ} 19' 53' 52''$, gives his place, in the year before Christ 880, $= 5^{\circ} 14' 13' 02''$. The latitude of this star, is, in the same catalogue, $= 30^{\circ} 57'$. Therefore, in the figure here, we have G M K B the ecliptic, R L K A the equator, C P the complement of the star's



(14) Hesiodus florebat eo sæculo quo Arcturus ἀρκτύρος orientabatur in Bœotia VIII die Martii, si quid hoc ad conjecturam facit, saltem apud excellentes astrologos, qui ex hoc parapegmate, infra Septuaginta plus minus annos, sæculum Hesiodi deprehendere possunt. *Animadversf. ad Euseb. Chron. Num. MCCLV.*

(15) Operæ vero est attendere ad id quod Hesiodus ipse scribat, sua ætate Arcturum ἀρκτύρον in Bœotia exortum fuisse VIII die Martii : Unde poetæ hujus ætas in tantum saltem possit colligi, ut error si quis sit saltem intra LXX annos sit constitutus. *Voss. de Poet. Græc. L. i. c. 2.*

latitude,

latitude, = $59^{\circ} 3'$, DC the distance of the poles of the ecliptic and equator, = $23^{\circ} 29'$, and the angle DCE, whose measure is GM, the star's longitude from the next solstitial colure, = $74^{\circ} 13' 02''$.

$$\begin{array}{r} \text{Then rad.} + \text{cof. DCP} = 74 \ 13 \ 02'' \text{---} 19.4345545 \\ \text{--- Cotang. DC} = 23 \ 29 \ 00 \text{---} 10.3620437 \end{array}$$

$$\begin{array}{r} \text{Tang. CE} = 6 \ 44 \ 25 \text{---} 9.0725108 \\ \text{PC} = 59 \ 03 \ 00 \end{array}$$

$$\begin{array}{r} \text{PE} = 52 \ 18 \ 35 \\ \text{Then cof. DC} = 23 \ 29 \ 00 \text{---} 9.9624527 \\ \text{Cof. PE} = 52 \ 18 \ 35 \text{---} 9.7863203 \end{array}$$

$$\begin{array}{r} 19.7487730 \\ \text{--- Cof. CE} = 6 \ 44 \ 25 \text{---} 9.9969879 \end{array}$$

Cof. DP = $55 \ 37 \ 20$ --- 9.7517851
the complement of which is = $34^{\circ} 22' 40''$ = the declination of Arcturus.

$$\begin{array}{r} \text{Sine PC} = 59 \ 03 \ 00'' \text{---} 9.9332931 \\ \text{Sine DCP} = 74 \ 13 \ 02'' \text{---} 9.9833104 \end{array}$$

$$\begin{array}{r} 19.9166035 \\ \text{Sine DP} = 55 \ 37 \ 20 \text{---} 9.9166290 \end{array}$$

Sine PDC = $89 \ 22 \ 50$ --- 9.9999745 the complement of which is PDG = $90^{\circ} 37' 10''$. The right ascension, therefore, of Arcturus, at that time, was = $180^{\circ} 37' 10''$.

Where

In the year before Christ 880. the time of the winter solstice was December 29. at 15 minutes past six o'clock in the morning, according to the vulgar reckoning; or, in the astronomical account, $28^d 18^h 15'$; and 60 days after this, brings us to February 27. when the Sun's place was $11^s 00^o 6' 23''$; his declination south $11^o 27' 18''$; his right ascension $332^o 11' 56''$; from whence we shall have his ascensional difference $KN = 9^o 8' 15''$. Then

The semidiurnal arc, in a right sphere, is	$90^o 00' 00''$
Ascensional difference	$9^o 08' 15''$
	<hr/>

Semidiurnal arc	$80^o 51' 45''$
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This, converted into time, gives the time of Sun-setting then at Athens $5^h 23' 27''$; from whence we shall have the nocturnal arc $13^h 13' 6''$.

Again; the Sun's oblique ascension is	$341^o 19' 11''$
Oblique ascension of Arcturus	$147^o 52' 40''$
	<hr/>
Difference	$193^h 26' 31''$

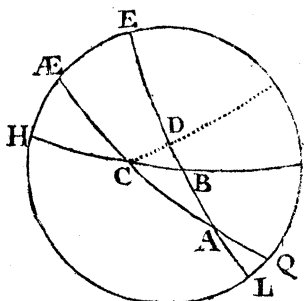
This, converted into time, gives	$12^h 53' 46''$
Nocturnal arc	$13^h 13' 06''$
	<hr/>
Difference	$00^h 19' 20''$
Semidiurnal arc, add	$5^h 23' 27''$
	<hr/>

Time of Arcturus's rising	$5^h 42' 47''$
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By this it appears, that at Athens, in the year before Christ 880, and 60 days after the winter tropic, the star Arcturus rose at $19^h 20''$ after Sun-setting.

But

But if we would inquire the time when it rose achronically, in the proper sense of the word, we have, in the figure here, EAL the ecliptic, $\mathcal{A}EAQ$ the equator, CD a portion of a secondary of the ecliptic perpendicular to EAL , AC the distance of the point of oblique ascension from the autumnal intersection $= 31^{\circ} 48'$; we have likewise the angle CAB the obliquity of the ecliptic, $= 23^{\circ} 29'$, and the angle $\mathcal{A}ECH$ the height of the equator at Athens, $= 51^{\circ} 55' = ACB$.



Then Tan. BAC	23	29	00	—	9.6379563
— Rad. + cof. AC	31	48	00	—	9.9293641

Cot. ACD	69	44	00	—	9.5673204
— ACB	51	55	00		

Sine DCB	17	49	00	—	9.4856820
Cof. BAC	23	29	00	—	9.9624527

				Sum	19.4481347
— Sine ACD	69	44	00	—	9.9722448

Cof. ABC	107	24	25	—	9.4758899
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Then Cof. BAC	23	29	00	—	9.9624527
— Rad. + Tan. AC	31	48	00	—	9.7924101

Tan. AD	29	37	35	—	9.7548628
L 11 2					Sine

$$\begin{array}{rcl} \text{Sine AD} & 29^{\circ} 37' 35'' & \text{---} 9.6940277 \\ \text{Tan. BAC} & 23^{\circ} 29' 00'' & \text{---} 9.6379563 \end{array}$$

$$\begin{array}{rcl} & \text{Sum} & 19.3319840 \\ \text{--- Tan. ABC} & 107^{\circ} 24' 25'' & \text{---} 10.5037429 \end{array}$$

$$\begin{array}{rcl} \text{Sine DB} & 3^{\circ} 51' 38'' & \text{---} 8.8282411 \\ \text{AD} & 29^{\circ} 37' 35'' & \end{array}$$

AB $25^{\circ} 45' 57''$ which taken from 6° , gives the point of the ecliptic rising with Arcturus; *i. e.* $\propto 4^{\circ} 14' 3''$; the point opposite to which is $\propto 4^{\circ} 14' 3''$. Then

$$\begin{array}{rcl} \text{Longit. of the Sun from the equinox} & 11^{\circ} 04' 14'' 03 & \\ \text{Precession of the equinox, subtract} & 11^{\circ} 24' 32'' 00 & \end{array}$$

$$\begin{array}{rcl} \text{Longit. of the Sun from 1st * of } \gamma & 11^{\circ} 09' 42'' 03 & \end{array}$$

$$\begin{array}{rcl} \text{Mean anomaly corresponding} & 8^{\circ} 29' 22'' 59 & \\ \text{Subtract 880} & 6^{\circ} 28' 27'' 12 & \end{array}$$

$$\begin{array}{rcl} & 2^{\circ} 00' 55'' 47 & \\ \text{March} & 1^{\circ} 28' 09'' 04 & \end{array}$$

$$\begin{array}{rcl} & 2^{\circ} 46' 43'' & \\ 2d & 1^{\circ} 58' 16'' & \end{array}$$

So that the Sun entered $\propto 4^{\circ} 14' 3''$, that year, March 2. at 19^h , in the astronomical account; or, in the vulgar

ulgar way of reckoning, at 7 o'clock in the morning, March 3. Either this day, therefore, or the preceding one, might, at that time especially, have been taken, indifferently, for the day when Arcturus rose achronically.

But tho' this is what is properly meant by achronical rising (19); yet as a star, at that time, is invisible, and, consequently, can be no rule for husbandmen, for whose use these observations were intended; there is another achronical rising, called the apparent one: This is when a star first appears above the eastern horizon after sun-set (20); which, therefore, requires some certain depression of the Sun in the opposite part of the heavens, more, or less, according to the magnitude of the star required to become visible.

It was said before, that in the year before Christ 880. Feb. 27. Arcturus rose, at Athens, 19' 20" after Sun-set; but whether this, tho' a bright star of the first magnitude, could be seen there so soon in the eastern horizon as even at 30 min. past Sun-set, may well be questioned: And therefore Feb. 27. or the 60th day after the winter solstice, could not be there esteemed the day of the apparent achronical rising of Arcturus.

- (18) Εὐτ' ἂν δ' ἐξήκοις μετὰ τροπᾶς ἡλείοιο
 Χερμέει' ἐκτελέσῃ Ζεὺς ἡμάδα, δὴ ῥὰ τότε Ἀστὴρ
 Ἀρκίῳ, προλιπὼν ἱερὸν ῥέον ὠκεανοῖο
 Πρῶτον παμφαίνων, ἐπτελλεῖται ἀκροκύνεσθαι.

Op. & Dief. l. ii. v. 185.

- (19) Εσπερία δ' ἐστὶν Επιστολή, ὅταν τῇ ἡλίῳ δύνῃ, ἐπτελλῇ τις Ἀστὴρ ἅμα κατὰ τὸ ὀρίζοντα γενόμενος. *Gemin. apud Petav. Uranolog. cap. xi.*

- (20) Ὅταν ᾗ μετὰ τῇ ἡλίῳ δύσειν πρῶτος ἐκπεφυγὼς τὰς ἀυγὰς τῇ ἡλίῳ θεωρηθῇ, τότε λέγεται φαινομένην εσπερίαν ἐπιστολήν πεποῖσθαι. ἐν τῇ ταύτῃ ἐχομέναις νυξὶ μεσεωρότερος αὐτὸ μᾶλλον, καὶ μᾶλλον φαίνεται. *Gemin. ibid.*

I have hitherto called it the star Arcturus; but it is not improbable that Hesiod meant the whole constellation Bootes (21). He calls it, indeed, ΑΣΤΗΡ; and that word, according to Macrobius (22), signifies only a *single star*. But whatever it might do in his time, it seems evident, that, among the antients, and especially the poets, that distinction was not always nicely observed (23). If this, therefore, should be the case with respect to Hesiod, the time of this rising of Arcturus will be something more indeterminate, as a constellation cannot rise all at once, nor is it now known how many stars this constellation, in particular, was, in those early times, supposed to consist of.

But farther; it hath been hitherto taken for granted, that Hesiod is to be understood as speaking of Asara, or some place in the neighbourhood of it; but this, likewise, is not altogether certain: For it was no unusual thing with the antients to set down in calendars, of this sort, observations on the risings and

(21) Ἀρκτὺρ ὃ λέγεται καὶ αὐτὸ ὄλ' ὁ Βούτης, ἰδίως δὲ καὶ ὁ ὑπὸ τῷ ζῶνῃ αὐτὴ ἀστήρ. *Suid. in voc. Ἀρκτ.* And so Theon; Ἐνα δ' ἔχει (Arctophylax) ἐν μέσῃ ζῶνῃ ἑῷς διὰ τῷ ὑπερβολὴν τῇ λαμπρότητι ἰδίως καὶ αὐτὸ λέγεται Ἀρκτερ, ὁμοίως τῷ παντὶ Ἀρκτῶρι. *In Arat. Phaenomen. p. 15.*

(22) Sic. & apud Græcos After & Astron diversa significant, & After stella una est; Astron signum stellis coactum, quod nos fidus vocamus. *In Som. Scip. l. i. c. 14.* Ἀστὴρ ὃ Ἀστρα δ. ἀφέρει· ὅτι ὁ μὲν Ἀστὴρ ἐν τεσσάρτοις τῷ Ἀστρῶν ἐκ πολλῶν συνεστῆκεν Ἀστέρων, Ζῳδίου ὅν' ὃ καὶ Ἀστροδέτημα καλεῖται. *Didym. in Illiad. iv. v. 75.*

(23) Aratus useth the words Ἀστὴρ and Ἀστρῶν indifferently.

— Σήματ' ἐν ἔργῳ ὠρῶ ἐστῆριζεν

Ἀστρα διακινεῖας ἐσκέψατο δ' εἰς ἐνιαυτὸν

Ἀστέρας, οἱ καὶ μάλιστα τετυγμένα σημαίνουσιν

Ἀνδράσιν ὄραων, ὅρ' ἔμπεδα πάντα φέωνται

Nūn δὲ ὁ Ἀρατος, says the Scholiast there, τὰς Ἀστέρας Ἀστρα εἴρηκε. *Pag. 3. Ed. Oxon.*

settings

settings of the stars made in very distant times and countries (24); the latitudes of places being unattended to, and the slow motion of the fixed stars about the poles of the ecliptic unknown, and indeed unsuspected, or disregarded afterwards, when it became suspected.

But tho' we should grant the place of observation to have been at, or near Ascrea, yet there will still remain a difficulty, with respect to the time. In the computation before given it hath been supposed, that Arcturus rose there achronically on the 60th day from the solstice, exclusive of the solstitial day itself; but as the particle *μετά* is sometimes taken inclusively (25), we may reckon the day of the solstice it-

(24) See the calendars in *Petav. Uranolog.* In qua aliorum & temporum & climatum confusione, præ aliis maxime hallucinatus est Manilius; qui Ægyptiaci cœli descriptiones Romano adaptasse, & Græcanicæ Barbaricæque sphaeræ observationes, nullo judicio, simul commiscuisse deprehenditur. *Bainbrig. Canicular.* p. 22. See, likewise, *Dodwel. Append. ad Cyprian. Dissert.* p. 19.

(25) Thus *μετ' ἡμέρας δύο* duobus diebus post. *Demosth. in Mid.* and *μετὰ πέντε* in *Diod. Sic.* p. 103. *Edit. Wechel.* Post septem lucas. *Ovid. Fast.* l. vi. v. 774. and what is *τῇ τρίτῃ ἡμέρᾳ ἀνασῆναι*, *Luke* xxiv. 7. is *μετὰ τρεῖς ἡμέρας ἐξίσομαι*, *Matt.* xxvii. 63. and *μετὰ πενήκοντα καὶ ἑκατὸν ἡμέρας*, in the LXX. *Gen.* viii. 3. is on the 150th day, as appears from the next verse. The Arabs use their particle *بعد*

likewise in the same manner. Thus *حولت القبلة الي*

الكعبة في رجب بعد الهجرة سبعة عشر
شهرًا وقيل في شعبان وحولت
الخمر بعد الهجرة جاريع سنين في السنة
الرابع *conversa est Keblah ad Caabam mense Rageb, mensibus post fu-*

gum 17. vel juxta alios mense Shaaban interdictum vero vinum 4
post fugam annis, anno sc. quarto. *Alkodaius in Pocock. Spec. Hist. Arab.*
p. 175. self

self one of the number, which, consequently, will bring us only to Feb. 26.

Besides; what hath been said, hath been built upon the supposition that the day of the solstice was, at that time, precisely known; a thing, however, not hastily to be granted. The inaccuracy of observations, and the want of proper instruments, in times much later than this we are here speaking of, would incline one not to attribute too much to them, in a case of so much nicety. Since, then, we find the solstice fell out so early in the morning; either December the 28th, or 29th, might have been taken for the solstitial day: And, accordingly, 60 days after will be either February the 26th, or 27th. But as the Sun's change of declination, at that season of the year, is very slow (26); an error of a day, or two, or more, either forward, or backward (a thing by no means impossible), will bring us to Feb. 25. or 28. which is a difference of no less than 4 days.

If any one thinks such a mistake as this incredible, let it be observed, that in the calendar prefixed, in some editions, to Ovid's *Fasti*, the Sun is said to enter Aquarius XV kalend. Feb. or Jan. 18. Ovid himself seems to place it XVI kalend. Feb. or Jan. 17. and with him agrees Pliny; tho' Columella, under the reign of Claudius, and Ptolemy, under Antoninus Pius, place it one day earlier, or the XVII kalend. Feb. Here is plainly a difference of 3 days, and yet all of them wrong: For Ovid, as is generally agreed, inscribed his *Fasti* to Germanicus soon after

(26) Keill. *Lect. Astron.* p. 250,

his banishment, or about *A. D.* 10. but, by the tables, the Sun entered Aquarius, that year, Jan. 21. and in the second year of Antoninus Pius, or *A. D.* 139. when Ptolemy observed the fixed stars, he entered the same sign Jan. 20^d 16^h, or at 4 o'clock in the morning Jan. 21. according to the vulgar reckoning.

But if such mistakes could be committed at this time, how little must we suppose the true time of the solstice known, so early as the year before Christ 880.

But not to assume too much, let us suppose a mistake of two days only, in the rising of Arcturus. By calculating as before, we shall find, that *A. C.* 1689. the point of the ecliptic rising along with Arcturus, in the latitude of Athens, was $\approx 10^{\circ} 35' 55''$, the point opposite to which is $\approx 10^{\circ} 35' 55''$. But this point the Sun entered, that year, March 20. when, consequently, Arcturus rose there achronically: But in the year before Christ 880. as before observed, Arcturus might be said to rise achronically there March 2. this gives a difference of 18 days in 2569 years; from whence a difference of 2 days will give 285 years, which subtracted from the year before Christ 880. will give the year before Christ 595. for the time of Hesiod, and, consequently, of Homer too, if contemporary with him, for any thing that can be gathered to the contrary from the achronical rising of Arcturus.

Having now shewn, in this manner, what little precision there is in this argument, I might, as I at first intended, take my leave of the subject, and refer the settling the age of these two poets to authorities of

M m m

another

another nature. But as the favourers of their high antiquity will, I question not, be startled to hear that their age may be brought down so low as the year before Christ 595. your lordship will not be displeased, I hope, if I add something farther in confirmation of this date, and shew, that it is not so unreasonable, or absurd, to fix them at this very time, as at first sight it may appear.

I shall not trouble your lordship with a variety of philological arguments, that, I think, I could produce in support of this assertion. That would swell this letter beyond the bounds of your lordship's patience: I shall therefore confine myself to a few internal evidences alone, taken from the poets themselves; which, being of an astronomical nature, will, I flatter myself, on that account, at least, recommend themselves to your lordship's attention.

The first that shall be offered, shall be from the following lines of the *Iliad* itself.

‘Οιον δ’ ἀστέρα ἦκε κρόνου παῖς ἀγυλομήτεω
 Ἡ ναύησι τέρας, ἥε στραῖω εὐρεῖ λαῶν,
 Λαμπρόν, τὸ δέ τε πολλοὶ ἀπὸ σπινθήρες ἱεῖναι.
 Τῷ ἐκὼν ᾗξεν ἐπὶ χθόνα Παλλὰς Ἀθήνη (27).

*Qualem autem stellam mittit Saturni filius versuti,
 Aut nautis portentum, aut exercitui lato populorum,
 Splendidam, unde multæ scintillæ emittuntur.
 Huic similis, impetu ferebatur in terram Pallas
 Minerva.*

Some, as Eustathius (28) himself, take this to be a description of a comet; and the justness of it will be acknowledged by all that remember the late one in 1743. By the beauty and liveliness of the description, likewise, one would be induced to believe farther, that it must have been the description of one seen by Homer himself. But if the comet that appeared in 1681. hath a period of about 575 years (29), as it seems to have, we shall find, by counting backwards, that it must have visited the earth about the year before Christ 619. at which time Homer might have been alive, and old enough to remember the terror and consternation that it caused.

Another remarkable passage there is, in the *Odyssey* (30), where, just before Ulysses recovered his wife and kingdom, the poet tells us, that

————— Ἡελίῳ δ' ἔ
Οὐρανῷ ἐξαπώλωλε, κακὴ δ' ἐπιδέδρομεν ἀχλὺς

————— *Sol quoque*
Ex cælo periit ; ominosaque ingruit caligo.

Ταῦτα δ' ἐὼς ἀπὸ ἡλίου ἐκλείψεως, says Eustathius there : And again, Ἡ δ' ἐτὺς ἡλίου ἐκλείψις οὐκ ἀπίθανον οἶα γενομένη ἐν Νουμηνίᾳ.

What authority Eustathius had for supposing that this transaction was at the new moon, I know not. I

(28) Ἀστὲρα δ' ἐν τῷ ἔκκυρίως λέγει, ἀλλὰ τὴν ἀστειδὲς οἶον Κομήτην ἢ σκηπτὸν ἄστρον.

(29) See Dr. Halley's *Astron. Tables*, or *Miscel. Curios.* Vol. II.

(30) Lib. XX. v. 356.

think it no-where appears from the poet himself. That it is a description of some total eclipse, is, however, not improbable: And tho' an eclipse, at the time Homer is speaking of, seems purely poetical; yet the great eclipse of the Sun, in the year before Christ 603. that parted the Lydian (31) and Median armies, must have made strong impressions on every Ionian's mind, that saw it, and may be here very beautifully introduced.

I desire no greater stress may be laid on these passages than they will bear: But I observe, that, in placing the age of Homer thus, we shall be enabled farther to solve a difficulty mentioned by Strabo (32). For this curious and accurate geographer and historian remarks, that Homer no-where mentions the empire of the Medes, nor the cities of Babylon and Tyre. But this last city was taken by Nebuchadnezzar, after a long siege (33), about the year before Christ 593. and was to continue, according to Isaiah (34), in a low despicable condition 70 years; and therefore, probably, did so the greatest part of Homer's life-time. The city of Babylon was, I think, taken by the

(31) *Herodot. p. 29. Edit. Gronov. See Maier's Chronolog. Scythic. in the Aet. Petropolit. Tom. III. and what I have said in the Philos. Transf.*

(32) Ομηρος γὰρ ἔτε ᾗ τὴ Σέρων ἔτε ᾗ Μιδων ἀρχὴν ὀδιδεν ἐδὲ γὰρ ἄν Θήβας Αἰγυπτίαν ὀνομάζων, καὶ τὴ ἐκεῖ, καὶ τὴ ἐν Φοινίκη πλεστον, ᾗ ἐν Βαβυλῶνι καὶ Νίνῳ καὶ Εὐφράτησι παρσιώσθησε. Pag. 1068. Οἱ μὲν ἔν ποιεῖται, ᾗ Σιδόνα τεθρυλλήκασιν μάλλον Ομηρῶς ᾗ ἐδὲ μέμνηται τὴ Τύρῳ. Pag. 1097.

(33) Ezek. xxix. 18. Ἐπὶ Βαβυλῶνι τῇ βασιλείᾳ ἐπωλήθησε Ναβουχodonosor ὁ Τύρον ἐπ' ἑτη δεκατρία. *Joseph. cont. Apion. p. 1344. Ed. Hudf.*

(34) Chap. xxiii. ver. 15.

Medes

Medes about the year before Christ 558. and about four years afterwards the Median empire itself was put an end to by Cyrus and his Persians (35). Within this period of time, therefore, it is now farther probable, from this observation of Strabo, that both the *Iliad* and *Odyssy* were composed.

And this, again, will receive an additional confirmation, by considering the following lines of the *Odyssy* (36) itself; where Eumæus tells Ulysses, that

Νῆσός τις Συρίη κικλήσκεται ἔκτου ἀκῆες
Ὀρτυγίης καδύπερθεν, ὅδι ΤΡΟΠΑΙ ΗΕΛΙΟΙΟ

*Insula quædam Syria vocatur, sicubi audis
Trans ortygiam; ubi MUTATIONES SOLIS.*

But what is to be understood by the words τροπαί ηελίοιο, or *mutationes Solis*, as the translator renders them? The word *tropics*, we know, is sometimes used for those points of the ecliptic through which the solstitial colure is drawn; but this cannot be the meaning of it here, as it is impossible that the tropics, in this sense, should be at the island Syra, or Syria. This island is one of the Cyclades, and lies, according to the best modern geographers, in latitude $37^{\circ} 25'$ north; where, consequently, the height of the equator is $52^{\circ} 35'$, and the Sun's zenith distance, on the day of the summer solstice, $13^{\circ} 56'$. Homer, therefore, could not mean, likewise, that this island

(35) The proof of this being too long for a note, is considered, at large, in a treatise by itself.

(36) Lib. xv. ver. 402.

lay under one of the tropics, much less that it lay under both.

Another signification of the word *tropic* is, when it is used for that moment of time when the Sun, by his apparent motion, enters either of the solstitial points: But neither could Homer use the word here in this sense. For the solstice, according to this meaning of the word, is not only at the island Syria, but every-where else; and is only sooner or later, in time, as places lie to the eastward or westward of each other. For if the time of the summer solstice, this year, is at 12 o'clock at noon, as reckoned at Greenwich, it will only be 11 o'clock to places that lie in 15° of western longitude; or 1 o'clock in the afternoon to such as lie in 15° eastern longitude from it.

The only remaining sense, then, of which the words τροπαὶ ἡλίου seem capable, is, as far as I can apprehend, by supposing that they mean some instrument or other, as a gnomon, or the like, erected there; which, by the increasing or decreasing lengths of its meridional shadows, pointed out the days of the solstices: I say the days; because, if those could be obtained, it was a degree of accuracy as great, I suppose, as observations of this sort could, in those times, pretend to.

And that we are not much mistaken in apprehending this to have been an instrument of this sort, may be gathered, perhaps, from Diogenes Laertius. For, in his life of Pherecydes, who was a native, at least an inhabitant, of this very island, he says, Σάξεται δὲ καὶ ἡλιότροπιον ἐν Σύρα. τῇ νήσῳ, *servatur et heliotropium in Syra insula.*

These

These words Aldobrandinus (37) suspects to be an interpolation. *Quid enim*, says he, *ad Pherecydem heliotropium*? But if we read the passage thus, as, probably, it should be read, *σάξεται ὃ καὶ ἡλιοτρόπιον* ΑΥΤΟΥ ἐν Σύρα τῇ νήσῳ; the whole will be consistent and pertinent to Pherecydes, and likewise be a direct proof of such an instrument being there, as we have supposed.

Peter Huet (38), it is true, suspects, from the passage in the *Odyssey* above-quoted, that this instrument was repaired only by Pherecydes there, and not first erected by him. But as this reasoning depends only on the supposed much greater antiquity of Homer, the very point in question, we are equally at liberty to suppose the contrary; and that Pherecydes was the original erecter of it in the island. And that this conjecture may not pass unsupported, it may be observed, that, according to Laertius (39), Anaximander, who lived about the same time, was the first inventor of the gnomon; or, rather, the introducer of it at Lacedæmon.

Pherecydes, according to Laertius, flourished about Olymp. LXIX. or the year before Christ 500. and Anaximander, he says, was 64 years old Olymp. LVIII. 2. or the year before Christ 543. and was, therefore, something older than the former, if the numbers in Laertius here may be depended on, a thing not always to be done.

(37) In Loc.

(38) And so Bochart, *Geog. Sacr.* Part II. l. i. c. 14. Vid. *Ménag. Observat. in-Loc.*

(39) In Vit. ejus.

The pole, the gnomon, and the division of the day into 12 parts, are expressly said by Herodotus (40) to have come from the Babylonians to the Greeks; and it is more natural to suppose, from the usual progress of science, that the islands nearest to the Asiatic coast were acquainted with these improvements before Peloponnesus, and the places more remote from thence. Pherecydes, therefore, it is probable, erected his gnomon at Syra somewhat earlier than Anaximander did his at Lacedæmon. But as we read of nothing of this kind among the Greeks before their time, we may conclude them to have been totally ignorant of these inventions as early as the year before Christ 610. when, if Laertius says true, Anaximander was born. But in the year before Christ 558. as before observed, Babylon was taken by the Medes; and it may be no absurd conjecture to imagine that such Chaldeans, as were forced from their native country by their enemies, and sheltered themselves among the Ionians, first taught them, and by their means the rest of the Greeks, their astronomical discoveries. It is certain, that the taking of Constantinople by the Turks hath had a like effect in later times (41).

(40) Πόλον μὲν γὰρ καὶ γνώμονα, καὶ τὰ δώδεκα μέρη τῆς ἡμέρας παρὰ Βαβυλωνίων ἔμαθον Ἕλληνες. Pag. 127. Edit. Gronov. Πόλος dicebatur, quod postea ὀρολόγιον, says Scaliger on *Manil.* p. 254. And so Athenæus Deipnosoph. l. v. speaks of Πόλον ἐκ τῆς καθ' ἑαυτὴν Ἀχραδινὴν ἀπαμειβιμμένων ἡλιατροπῶν. And Aristophanes in *γρητυαδῆ* says, Πόλος τὸ δ' ἐστίν· Εὐασαποσὴν ἥλιος τέτραπται. And Jul. Pollux says, *Cottabium*——ἐῶκει δὲ πόλῳ τῶς ὥρας δεκνύνῃσι. L. vi. cap. 19.

(41) The Turks fate down before that place April 4. 1453. and, when they took it, destroy'd 120000 volumes. See *Hod. de Græcis Illust.* &c. p. 192.

How long before this the Babylonians themselves were acquainted with the use of the gnomon, is unknown, the Greeks being poorly informed, as to the history of them, in these early times; and the Jews, the only people besides whose history of them is extant, applied themselves but little to science at home, and, by their constitution, had but a small connection with their neighbours abroad. With regard to the science of astronomy, in particular, it must have been, as then taught and practised, in a manner, forbidden them, as it was nothing more than genethliacal astrology; a thing vain and futile in itself, if not impious.

Among the Jews, however, we find, under the reign of Hezekiah, that the Sun is said to have gone back 10 degrees on the dial of Ahaz (42). What the

(42) *Isa.* xxxviii. 8. and 2 *Kings* xx. 11. In the Hebrew, the words are only מעלות אחר, the last of which words the LXX render ἀναβαδυσας; the Arab. درجات; the Vulgate by *Linea, Horologium, and Gradus*. The Chaldee Paraphrast labours, under equal perplexity. Rabbi Kimchi, on 2 *Kings* xx. renders מעלות by אבן מכוונת לדעת שעת היום, a stone erected to tell the hours of the day by. And to the same purpose R. Solom. Jarch. on *Isaiah*. It may not be improper to add in this place, perhaps, that as the 11 stars correspond to Joseph's 11 brethren, *Gen.* xxxvii. 9. and the 3 branches, and 3 baskets, respectively denote 3 days, in *ch.* xl. 12. 18. and 7 kine, and 7 ears of corn, represent 7 years; so, in the passage before us, the number of מעלות ought, for the same reason, to correspond with the years added to Hezekiah's life. If 15 years were added to his life, then must the shadow have gone back 15 *maaloth*; but if the shadow went back only 10 *maaloth*, then must 10 years only have been added to his life. The numbers in this place, therefore, are, some how, or other, undoubtedly corrupted. I am inclined, then, to think, that, instead of *I will add to thy life*

the form of this dial was, is unknown; but it may not be improbable, that it was copied from the Babylonians, as that prince seems to have been curious and fond of exotic customs. This was about the year before Christ 724. and, consequently, 166 years before Babylon was taken, and 114 before Anaximander was born.

I call this a dial, in compliance with custom, and for want of a better term to express it by; tho' it was, probably, nothing more than a gnomon erected perpendicular to the plane of the horizon; and served not only for distinguishing the different parts of the day, but in a rude manner, likewise, the times of the solstices and equinoxes. For the ingress of the Sun into the four cardinal points might be thought, by the astrologers, to have been of as much consequence, in resolving genethliacal questions, as knowing the time of the day: I say the time of the day; because the hours marked out, by instruments of this kind, were not equable, or equinoctial hours, but popular; being longer or shorter, in any assigned place, according to the different season of the year.

15 years, it should be, *I will add to thy life 10 years*; the shadow going back, to denote this, only 10 *maaloth*. For as the Babylonian and Jewish day consisted only of 12 hours, it is highly probable, that, on these kind of instruments, there were no more than 12 *maaloth*. The shadow, therefore, could not go back 15 *maaloth*; nor, consequently, agreeable to the rule before laid down, pertinently represent the addition of 15 years. It was to this division of the day into 12 parts that Crassus alluded, when he said to king Deiotarus, * *Quid hoc rei est, duodecima jam tibi tantum non in-
' stat hora, & novam nihilominus urbem ædificare pergis?*' *Cæl. Rhodigin.* p. 318.

How

How early the Greeks had the use of the word *ώρα*, is not agreed on. The Babylonians, as we learn from the book of *Daniel* (43), used the equivalent word *נְתַנְנָן* at least as early as the reign of Nebuchadnezzar, or the year before Christ 616. when Jerusalem was first taken by that prince, and 6 years before the birth of Anaximander. But that the divisions on his, or Pherecydes's dial, were called *ΩΡΑΙ*, is not so clear.

Salmasius (44) says, the word was unknown to the Greeks for more than two hundred years after the death of Anaximander: And farther, that it is never used by Plato, Aristotle, Theophrastus, nor any author of that age; nor even by Menander, or any other writer of the *new Comedy* after the time of Alexander the Great.

But, with deference to this opinion of his, it may be observed, that there is a passage in Xenophon (45) where the word *Ωρα* seems used in the sense contended for. Ουκ᾽ ἔν κ' ἐπειδὴ ὁ μὲν ἡλιος (says Socrates) φωτεινὸς ὢν τὰς τὲ ΩΡΑΣ τ' ἡμέρας ἡμῖν κ' ἄλλα πάντα σαφηνίζει· ἢ ὃ νύξ, διὰ τὸ σκολεῖν εἶναι ἀσαφέστερα εἶναι, ἄστρα ἔν τῇ νυκτὶ ἀνέφηναν, ἃ ἡμῖν τὰς ΩΡΑΣ τ' νυκτὸς ἐμφανίζει, κ' διὰ τὸ πολλὰ ὢν δέουμεθα πράτλο-

(43) *Dan.* iii. 15. iv. 16.

(44) Certe novæ comediæ scriptores, quorum princeps Menander, qui post Alexandrum magnum vixerat, nusquam τ' *ωρας* meminere pro diei particula, ut grammatici nobis veteres testantur. Sed nec ea vox hoc sensu apud Platonem, Aristotelem, Theophrastum, aut alios æquævos scriptores usquam legitur. *Plinian. Exercit.* p. 633.

(45) *Memorabil.* l. iv. cap. 3. sect. 4. And so Herodotus, before him, useth the word, p. 529.

αεν. *Quia vero Sol lucidus est, ac nobis HORAS diei, aliaque omnia clare demonstrat, nox autem propter tenebras est obscurior, astrorum lucem noctu protulerunt (Dii) quæ nobis HORAS noctis indicarent; quo fit, ut multa tum quorum opus est perficiamus.* But Xenophon flourished, according to Laertius (46), about Olymp. XCIV. 4. or the year before Christ 397. and about 148 years after the death of Anaximander; at which time, it seems now, the Greeks were acquainted with the word ὥρα.

But tho' the word ὥρα itself could not be proved to have been in use among them at this time, yet it seems as if they had what was equivalent to it before: For according to Menander, as cited by Julius Pollux (47), what was then called ὥρα, *an hour*, and ἡμιώριον, *half an hour*, was called παρὰ τοῖς παλαιαῖς *by the antients*; Σημεῖον, *a mark*: And the reason, I suppose, was, because the ends of the shadows were marked with the letters of the alphabet, called Στοιχεῖα, *elements*, as their lengths were measured by feet. And as the day was divided into XII parts, so the greatest length of their shadows were XII feet; the Sun being after this, in the evening, and before this, in the morning, too low to make any farther measures useful.

Instances of what hath here been said, are easily to be met with in the comic writers. Thus in Aristophanes's *Concionatrices* (48).

(46) *In Vit. ejus.*

(47) *Pag. 47. Edit. Kuster.*

(48) *Pag. 457. ibid.*

—σοὶ ᾧ μελήσει .

Οἶαν ἢ ΔΕΚΑΠΟΥΝ τὸ ΣΤΟΙΧΕΙΟΝ λιπαρῶς
χωρεῖν ἐπὶ δειπνον.

—*tibi autem curæ erit*
Quando fuerit decem pedum elementum pingue
(unctum) ire ad cœnam.

Upon which word ΔΕΚΑΠΟΥΝ, the scholiast observes, ἡ τῆς Ἡλίου σκιά οἶαν ἢ δέκα ποδῶν· θέλει ἔν εἰπεῖν ὅτε γίνεσθαι ὀφέ. Ἀλλως τὸ παλαιὸν καλέντες ἐπὶ δειπνον καὶ καλέμενοι παρεσημαίνοντο τὴν σκιάν, καὶ ἕως οἱ μὲν ἔμενον τῆς κληθέντας, οἱ δὲ ἀπῆσαν ἐπὶ τὰς ἐξιάσεις, οὐδέπω τηρήσεως (Vid. *Casaub. in Athenæum*, p. 425. 49.) ἔσης εἰέρας, ἃς οἶον τε τὴν τεκμήρας εἰς πόσας ὥρας ὑποοίκει. *Quando Solis umbra sit decem pedes longa, q. d. quando sero fit. Aliter; antiquitus ad cœnam invitantes & invitati umbram notabant, unde hi invitatos manebant, illi ad convivium se conferebant, quum nulla alia esset observandi ratio, qua indicium fumerent quot horas jam dies declinasset.* And Hesychius likewise informs us, that τοῖς ποσὶ καλεμέτρουν τὰς σχιάς ἐξ ὧν τὰς ὥρας εἰγίνωσκον.

And that twelve was the whole graduation, and twelve feet the longest shadow in dials of this form, may be collected, I think, from this epigram, cited by Salmasius, on Solinus (49):

Ωρῶν σκοπιάζε σοφὸν σημάδιον χαλκὸν
Αὐτῆς ἐν ΜΟΝΑΔΟΣ μέλει ΔΥΩΔΕΚΑΔΟΣ.

And before this, in a fragment of Menander (50), it is said,

— διαφέρει Χαιρεφώνη οὐδ' ἔργῳ
 Ἄνθρωπος ὅστις ἐστὶν ὅς κληθεὶς ποιεῖ
 Εἰς ἐστίασιν ΔΩΔΕΚΑΠΟΔΟΣ ὄρσει
 Πρὸς ἣ Σελήνην ἔλκεται ἢ σκιάν ἰδὼν
 Ὡς ὑπερίζων καὶ παρὴν αἶμα' ἡμέραι

— a Chærophonte nullo modo
*Homo differt, quisquis est, qui vocatus aliquando
 Ad convivium, cum umbra decem pedum foret, summo
 mane
 Ad Lunam cucurrit conspiciatus umbram
 Quasi æquo diutius moratus, & adfuit una cum die.*

And Hefychius, on the word ΔΩΔΕΚΑΠΟΔΟΣ, says, ὥτως ἔλεγον ἐλλαπλικῶς τοιχείου ἢ σκιάς· ἔγω γὰρ συνέλιθεντο ἐπὶ δᾶπνον ἤξεν τῇ τοιχείου ἐν τῷ ΔΩΔΕΚΑΠΟΔΟΣ, ὡς νῦν πρὸς ΩΡΑΣ φασί. *Ita dixerunt, subintellecto elemento vel umbra. Sic enim ad cœnam conventuros pacti sunt olim existente elemento duodecim pedes longo, ut nunc ad horas fit.*

I have dwelt the longer on this head, as it helps us to form some judgment on the nature of all these dials, as well that of Ahaz, as those of Pherecydes and Anaximander; the תימן of the first being naturally very capable of being mark'd ΣΤΟΙΧΕΙΟΙΣ on the other (51).

(50) *Menand. Reliq.* p. 139. *Edit. Cleric.*

(51) The Hebrew word comes from תלע, *scandit, ascendit*; and the Greek word from ΣΤΕΙΧΩ, *eo, vado, &c.*

But to return : If the Greeks were not acquainted with this invention of the Babylonians earlier than the year before Christ 610—If Pherecydes about that time first set up his dial in the island Syra, and Homer alludes to it in his *Odyssy*, as seems highly probable ; then must he, and consequently Hesiod, if contemporary with him, not be older than what we above have made him.

However strange this argument, drawn from the dial of Pherecydes, may appear to some, yet that I am not singular in it, is evident, from this note of Barnes upon the place : ‘ Qui hæc de heliotropio
 ‘ sumunt, *says he*, parum vident, aut plus satis ; quod
 ‘ & illud a Pherecyde inventum, atque proinde Ho-
 ‘ mero parem, aut priorem allucinantur, Cl. Dod-
 ‘ velli rationes nihil faciunt : cum Lycurgus, qui ip-
 ‘ sas Olympiades præcessit, Homeri opera, a Cre-
 ‘ phyli Samii posteris excepta, in Græciam primus
 ‘ intulerit, ut Heraclides & Plutarchus in Lycurgo.’

That Lycurgus is commonly placed before the Olympiads, is true ; but the history and chronology of that lawgiver is not so certain as to leave no room to suspect the contrary. Mr. Dodwell, whose skill in chronology was vastly superior to that of Barnes, says, there are very good reasons for supposing him to be later (52) : And with him agrees Sir Isaac Newton (53).

As to the assertion of Plutarch, it may be observed, from Strabo (54), that, according to some,

(52) *De Cyc. Vet.* p. 131.

(53) *Chronol.* p. 126.

(54) *Geograph.* p. 739.

Lycurgus himself had an interview with Homer in the isle of Chios; and Plutarch, likewise, was no stranger to the same report (55).

As a farther confirmation, however, that we are not very wrong in placing the age of these two poets as we have done, it may be remarked, that, in the description given by Hesiod of lucky and unlucky days, he tells us, *τετρηκάδα μηνὸς ἀρίστην* (56). But the first person, among the Greeks, that called the last day of the month by that name, or that used the word ΤΡΟΠΑΙ, if we believe Laertius, was Thales. Neither Homer nor Hesiod, therefore, if this observation be true, can be older than Olymp. XXXV. 1. or the year before Christ 637. when that philosopher was born. But as it must have been some time before he could apply himself to astronomical studies, and probably not till the middle part of his life, or about the year before Christ 600, the *Odyssy* could not well have been composed before.

But Pisistratus, as we are informed by Tully (58), first collected Homer's verses, and digested them in the manner we now have them. And Solon, according to Laertius (59), proved the right of the Athenians to the island Salamis, from these lines of the *Iliad*:

(55) *Vit. Lycurg.*

(56) *Dierum. v. 2.*

(57) *In Vit. ejus.*

(58) Qui primus Homeri libros, confusos antea, sic disposuisse dicitur, ut nunc habemus. *De Oratore*, l. iii. Πεισιστρατὶς συναρτάσων ἀπέφηνε τὴν Ἰλιάδα καὶ Ὀδύσσειαν. *Ælian. Var. Hist.* l. xiii. c. 14.

(59) *In Vit. ejus.*

Αίας δ' ἐκ Σαλαμῖν' ἄγεν δυνάκιδεκα ῥῆας
 Στήσσε δ' ἀγῶν ἰν' Ἀθηνάων ἱεραῖο φάλαγγες.

Solon, according to Laertius, flourished about Olymp. XLVI. and in the 3d year of it was archon, and published his laws. This was the year before Christ 590. What his age was at that time, he doth not tell us, but that he was 80 at his death; which by Plutarch, in his life of that lawgiver, is placed Olymp. LIII. 3. or the year before Christ 562. If so, he must have been about 52 the year that he was archon. And that he could not have been very young then, is plain, from the post and credit he was in.

Upon the expiration of his archonship, as we are informed by Plutarch, he travelled for 10 years, and returned an old man, as indeed he was, being now about 62 years of age: This was the year before Christ 580. During this interval, it is highly probable, he had his interview with Cræsus (60) and brought back with him, to Athens, Homer's poems, which he might meet with at Smyrna, or some other of the Ionian cities. Upon his return, he found his country torn with factions, and that Pisistratus had formed the design of making himself master of the state, which he soon afterwards effected. What year

(60) *Herodot.* p. 11. *Edit. Gronov.* Τὴν δὲ πρὸς Κροῖσον ἐνέτευξεν αὐτῷ δοκῶσιν ἐνιοι τοῖς χρόνοις ὡς πεπλάσμενιν ἐλέγχεεν. Ἐγὼ δὲ λόγον ἐνδοξον εἶπω, καὶ τοσούτης μάστιγος ἔχοντα, καὶ (ὁ μὲν ζῶν ὄντι) πρῶτοντα πᾶσι Σόλων' ἦδη καὶ τὸ ἐκείνου μεγαλοφροσύνης καὶ σοφίας ἀξίον, ἔμοι δοκῶν προσέειπε, χρεονικὸς τίσι λεγμένοις κατόσιν, ὥς μυρία διορθῶντες ἄλλοι σήμερον ἔς ἑδὲν αὐτοῖς ὁμολοῦντο δυνάμει καλῶς ἔσσαι τὰς ἀνιλοφίας. *Plutarch. Vit. Solon.*

this was in, is uncertain. The Oxford marble (61) placeth it, as doth Plutarch in the archonship of Co-meas, which is supposed to concur with Olymp. LIV. 4. or the year before Christ 557. But Tatian (62), Clemens Alexandrinus (63), and Scaliger (64), among the moderns, fix the government of Pisistratus to Olymp. L. or 577 years before Christ. And this, indeed, agrees best with Plutarch; who says, that Pisistratus, after seizing the administration, 'honoured' and esteemed Solon, and often sent for him, and advised with him.'

In what year Pisistratus digested Homer's poems, is not said; but it was, most probably, some time, or other, while he was in credit; and therefore, it is likely, about this very year 557. before Christ.

In the years of Solon's life, and Pisistratus's government, I have hitherto followed the chronology of the Greeks; which, however, I am apt to think, placeth them both somewhat higher than they ought to be; a fault not to be corrected in this instance alone.

It is natural to ask, what could induce Solon and Pisistratus, whose schemes of politicks were so widely different, to concur in recommending and encouraging the singing Homer's works. If the beauty and elegance of the composition alone be thought a sufficient answer, it must be observed, that such distinguishing care of them, shewn by two such able

(61) ΑΦΟΥ ΠΕΣΙΣΤΡΑΤΟΣ ΑΘΗΝΩΝ ΕΥΤΡΑΝΝΕΥΣ ΕΝΕΤΗ ΗΗ[Δ]ΔΔΔΠΗ ΑΡΧΟΝΤΟΣ ΙΚ ΟΥ. Ν° 56. where see the Commentators.

(62) *Contra Græcos.*

(63) *Stromat. l. i.*

(64) *In Euseb.*

statesmen, seems to intimate some deeper views than the world hath hitherto been apprised of.

Augustus, it is said, set a very high value on the *Æneid*; and the design of the poet in composing it is well known; but the drift of the *Iliad*, I think, hath not been so well agreed on.

The Trojan war, as the most judicious of the Greek historians (65) informs us, was in itself nothing near so considerable as the poets had made it. But for what end was this? Was it the sports of the imagination only? Were heaven and earth armed for nothing more than the writer's fancy, and the reader's amusement? Something more interesting, sure, was at the bottom of all this machinery; and, if I am not much mistaken, the very circumstances of the times, we are now speaking of, naturally gave birth to such a poem as the *Iliad*.

The Persian empire, by the conquests of Cyrus, was growing very extensive and formidable, and must, consequently, greatly alarm the Ionians, who might justly apprehend their sharing the same fate with the Assyrians, Medes, and Lydians. That he had formed a design of invading them, appeared, as we are informed by Herodotus (66), from the answer he gave their ambassadors. This they could not but see, and at the same time perceive themselves unable to op-

(65). Καὶ αὐτὰ γὰρ δὴ ταῦτα ὀνομασίταια τῶν πρὶν μενόμενα δηλοῦνται τοῖς ἔργοις Ἀπολλωνίου ὅσα τῆς οἰμῆς, καὶ τῇ νῦν περὶ αὐτῶν διὰ τοῦ Ποιητῆς λόγῳ κατέσχηκότε. *Thucyd.* l. i. sect. 14.

(66) The passage is too long to be transcribed. See *Herod.* p. 58. *Edit. Gronov. and Thucyd.* lib. i. sect. 16.

pose him, unless by a timely union among themselves, and with the rest of the Greek states in Europe, and the islands adjacent to the Asiatic coast. Such a confederacy had formerly subsisted, and Asia had felt the effects of it in the destruction of one of its states. This, indeed, was the work of a ten years war ; but that, on the other hand, was owing only to the quarrels and dissensions of the princes engaged in it ; a lesson very proper to be inculcated at this juncture, when they were to fight in the cause of liberty, when they might expect the same gods would be on their side as formerly, and had stronger motives to unanimity in their councils, than when they were only revenging the injuries offered to a single family.

To promote such a confederacy as this, appears to me to be the plan of Homer's *Iliad*. This, as a bard, he was employed to sing at feasts and entertainments ; and the introducing and encouraging such a poem by Lycurgus at Sparta, and Solon at Athens, was every way worthy the character and wisdom of those law-givers.

But if such a confederacy could once be formed, it was plain, the Athenians, the most considerable of their states at that time, would bear the greatest share in it : Whoever, therefore, was master of Athens, would, of course, be at the head of the whole alliance. Without such a head, and furnished with proper authority to command obedience, former experience had taught them what great disadvantages must unavoidably arise to the common cause. Therefore,

Οὐκ ἄλ᾽ ἄν Πoλυκοιρανίη, Εἰς Κόιραν ἔξω,
 Εἰς ΒΑΣΙΛΕΥΣ, ᾧ ἔδωκε Κρόνου παῖς ἀγκυλομήτεω
 Σκῆπτρον τ' ἠδὲ Δέμιττας, ἵνα σφίσιν βασιλεύῃ (67).

Is it at all surprising, then, that Pisistratus, whose abilities and interest appear to have been very great, should seize the government of Athens at this time? And doth there not appear the highest reason in the world why he, as well as Solon, should take such particular care of Homer's poems. Upon the whole, then, I think, it may be concluded, with a good degree of probability, from what hath been here laid down, that the *Iliad* and *Odyssey* were both composed about the time of Cyrus, or the year before Christ 558. if, as the antients generally do, we make his reign to commence from his taking of Babylon.

And since those that make Hesiod the oldest of the two poets, place him but a few years earlier than Ho-

(67) *Iliad*. ii. v. 204. It was natural for the Ionians to apply themselves to the Athenians, as being the largest maritime power, and because, as Thucydides informs us, Ἴωνες μὲν Ἀθηναῖοι καὶ Νησιωτῶν τὰς πολλὰς ὤκισαν. Pag. 11. *Edit. Waff.* See, likewise, *Meursi. de Fort. Athen.* c. 6. Herodotus says, that, upon this occasion, all the Ionians, except the Milesians, met in their common council called παρῶ 10. ; and that ἐξ ὅξε κοινῶ λόγῳ πέμπειν ἀγέρας ἐς Σπάρτην δεινομαβεῖας ἴωσι τι μωρέειν. The reason, perhaps, of their sending to Sparta, was, to engage the Peloponnesians; that being not only the principal city there at that time, but, likewise, having an old quarrel with the Asiatics ever since the Trojan war. Why he hath not mentioned their sending to the Athenians, is not very evident: Perhaps the members of this council, out of hatred to the rest of the Greek cities in their neighbourhood, planted by the Athenians, refused to ask their assistance: And this reason Herodotus himself seems to help us to. Οἱ μὲν νῦν ἄλλοι Ἴωνες καὶ Ἀθηναῖοι ἐφυγον τέτομα ἢ βυλόμενοι Ἴωνες κεκλήθη, ἀλλὰ καὶ νῦν φαίνονται μοι οἱ πολλοὶ αὐτῶν: παρὰ χυμένας τῇ ὀνόμασι. Pag. 59.

mer,

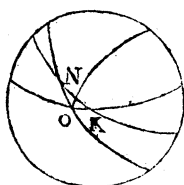
mer, not enough, however, to cause any observable change in the rising of the fixed stars; we may take the difference, at a medium, at 20 or 22 years; which will bring us to the year before Christ 580. for the time when Hesiod flourished.

Nor will the argument from astronomy be at all inconsistent with this determination. For in the year before Christ 580. the time of the winter solstice was December 27. in the morning; and 60 days after that will bring us to February 25. when the Sun's true place, at noon, was $10^{\circ} 29' 47'' 30''$, his declination south $11^{\circ} 33' 56''$, and his right ascension $331^{\circ} 53' 53''$. Then, in the figure here,

$$\begin{array}{rcl} \text{Tan. NO} & = & 11^{\circ} 33' 56'' \quad 9.3109992 \\ -R + \cot. NKO & = & 51^{\circ} 55' 00'' \quad 9.8941114 \end{array}$$

$$\text{KN} = 9^{\circ} 13' 45'' \quad 9.2051106$$

= the Sun's ascensional difference.



From the year before Christ 580. to the end of the year after Christ 1689. are 2269 years; the precession for which time is $1^{\circ} 1' 30' 50''$; which, subtracted from $6^{\circ} 19' 53' 52''$, as before, gives the place of Arcturus, the year before Christ 580 = $5^{\circ} 18' 23' 2''$; and the angle DCE, in the 2d figure, = $78^{\circ} 23' 2''$. Then

$$\begin{array}{rcl} \text{Rad.} + \cot. DCE & = & 78^{\circ} 23' 02'' \quad 19.3039589 \\ - \cot. DC & = & 23^{\circ} 29' 00'' \quad 10.3620437 \end{array}$$

$$\begin{array}{rcl} \text{Tan. CE} & = & 5^{\circ} 00' 00'' \quad 8.9419152 \\ PC & = & 59^{\circ} 03' 00'' \end{array}$$

$$\text{Cof. PE} = 54^{\circ} 03' 00'' \quad 9.7686966$$

Cof.

$$\text{Cof. PE} = \overset{\circ}{54} \overset{'}{03} \overset{''}{00} — 9.7686966$$

$$\text{Cof. DC} = 23 \ 29 \ 00 — 9.9624527$$

$$\text{Cof. DE} = \overset{\circ}{5} \ 00 \ 00 — 19.7311493$$

$$9.9983442$$

$$\text{Cof. DP} = 57 \ 16 \ 55 — 9.7328051$$

the complement of which, = $32^{\circ} 43' 05''$, = the declination of Arcturus.

$$\text{Then, in 3d fig. Tan. MO} = \overset{\circ}{32} \ \overset{'}{43} \ \overset{''}{05} — 9.8078283$$

$$— \text{Rad.} + \text{cot. MKO} = 51 \ 55 \ 00 — 9.8941114$$

$$\text{Sin. KO} = 30 \ 13 \ 35 — 9.7019397$$

= the ascensional difference.

$$\text{Sin. PC} = 59 \ 03 \ 00 — 9.9332931$$

$$\text{Sin. DCP} = 78 \ 23 \ 02 — 9.9910119$$

$$\text{Sin. DP} = 57 \ 16 \ 55 — 19.9243050$$

$$9.9249738$$

$$\text{Sin. PDC} = 86 \ 49 \ 20 — 9.9993312$$

the complement of which = $93^{\circ} 10' 40''$. The right ascension, therefore, of Arcturus then, was $183^{\circ} 10' 40''$; from which subtracting the ascensional difference found above, gives the oblique ascension of Arcturus = $152^{\circ} 57' 05''$.

$$\text{Then the semid. arc in a right sphere} = \overset{\circ}{90} \ \overset{'}{00} \ \overset{''}{00}$$

$$\text{Sun's ascensional difference} \quad 9 \ 13 \ 45$$

$$\text{Semidiurnal arc} \quad 80 \ 46 \ 15$$

which,

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which, converted into time, gives $5^h 23' 5''$; whence the nocturnal arc = $13^h 13' 50''$.

Sun's oblique ascension	341° 07' 38"
Oblique ascension of Arcturus	152° 57' 05"

Difference $188^{\circ} 10' 33''$

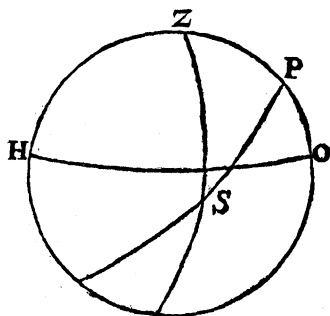
This, converted into time, gives $12^h 00' 42''$
Nocturnal arc $13^h 13' 50''$

Difference $1^h 13' 08''$
Add semidiurnal arc $5^h 23' 05''$

Time of the rising of Arcturus $6^h 36' 13''$
Time of Sun-setting at Athens $5^h 23' 05''$

Arcturus therefore rose, after Sun-set there, $1^h 13' 08''$

Let us now suppose, farther, that twilight ends when the Sun is 18 deg. below the horizon; and therefore, in the figure, where HO represents the horizon, PO the height of the pole at Athens, we have ZP the complement of $PO = 51^{\circ} 55'$, PS = the distance of the Sun from the pole, = $101^{\circ} 33' 56''$, ZS = the Sun's distance from the zenith, = 108° . Then,



Z S

$$\begin{array}{rcl}
 ZS & = & 108^{\circ} 00' 00'' \\
 PZ & = & 51^{\circ} 55' 00'' \text{ arith. complem.} = 0.1039621 \\
 PS & = & 101^{\circ} 33' 56'' \text{ arith. complem.} = 0.0089087 \\
 \hline
 \text{Sum} & = & 261^{\circ} 28' 56'' \\
 \text{Half} & = & 130^{\circ} 44' 28'' \quad \text{---} \quad \text{---} \quad \text{---} \quad = 9.8794779 \\
 \text{--- } ZS & = & 108^{\circ} 00' 00'' \\
 \hline
 \text{Diff.} & = & 22^{\circ} 44' 28'' \quad - \quad - \quad - \quad = 9.5872258
 \end{array}$$

Sum = 19.5795745

Half Sum = 9.7897872 = the cofine of $51^{\circ} 57' 15''$; the double of which is = $103^{\circ} 54' 30''$ = ZPS; which, converted into time, gives $6^h 55' 38''$ for the end of twilight. Since, therefore, Arcturus rose at $6^h 36' 13''$, and, consequently, near $20'$ before the end of twilight; it might then be said very properly, in the popular and less determinate sense of the word, to rise ΑΚΡΟΚΝΕΦΑΙΟΣ.

From what hath been said, my lord, doth it not seem pretty clear, that Homer and Hesiod both lived about the year before Christ 580. and that, as I said, from several arguments of an astronomical nature? The only difficulty that, I think, can be made to this, is, how to reconcile it with the express testimony of Herodotus to the contrary. In his life of Homer, as we have seen (68), he places him 622 years before the expedition of Xerxes into Europe; but in his history he says, both Homer and Hesiod were not

more than 400 years before his time ; that is, since there were but 50 years between the Peloponnesian war and the battle at Salamis (69), little more than 450 years before the same expedition.

Scaliger, in his notes on Eusebius (70), corrects the former passage of Herodotus by the latter ; and, instead of *ἐξαχόσια*, reads *τέτραχόσια* ; which will place Homer about the year before Christ 902. consistent enough with Paterculus and the marble (71), but different from his history by 71 years.

Whether this correction of Scaliger's be right, or not, I shall not here stand to enquire ; but I am apt to think the word *τέτραχόσιαις* itself, in Herodotus, is corrupt.

The Greek chronology, like that of other nations, hath been generally carried up too high ; the natural consequence of ignorance, and a defect of memoirs. This is only now to be corrected by persons of learning and abilities, capable of examining and comparing things with each other. In the time of Herodotus, no doubt, the popular accounts of Homer and Hesiod carried them up much beyond their proper time : But this writer, a better judge than the generality of people, seems to me to correct those mistakes, by saying, that they lived — years before his time, *and no more*. The words *no more*, appear plainly to intimate, as if, in the passage in question, Herodotus made the age of the two poets not near so great as the common chronologers of his time ; whereas his number, as it now

(69) Scholiast. on *Thucyd.* p. 64. *Edit. Waff.*

(70) Pag. 102.

(71) See Not. I. 2.

stands, differs inconsiderably from what they, most probably, made it. What his genuine number was, is difficult to determine; but, from what hath been said, I am inclined to think it was H H H 300; and that it was changed by accident afterwards, by the negligence of transcribers, or by some interpolator, to make it more conformable to the received chronology, into H H H H 400, as in our present printed copies.

And, in favour of this correction, it may be remarked, that Aristeas, the Proconnesian, as we are informed by Strabo (72), was, according to some, Homer's master. This Aristeas seems placed, by Herodotus, 340 years before his time (73); but Mr. Dodwell (74) intimates as if he had found, in some copies of this author, only 240; and says, that this number is confirmed by Tzetzes (75).

I have now finished all that I shall trouble your lordship with, at present, upon this head. What hath been here advanced, your lordship will regard,

(72) Pag. 946.

(73) Τὰ ὅ οἶδα Μεταπονήνισι τοῖσι ἐν Ἰταλίᾳ συγκυρήσαντα μετὰ τὴν ἀνάγινιν τὴν δευτέραν Ἀριστέω ἔτεσι τετρακόσια καὶ τεμνοσίοισι. Pag. 227.

(74) Quo tamen in loco 240 legunt, ni fallor alia exemplaria, suffragante, ut arbitror, in Chiliadibus Joanne Tzetze. *De Cyc. Vet.* p. 130.

(75) After telling the same story that Herodotus doth of Aristeas's death and revival, he adds,

Ἐπεὶ τα Αειμάσπια λεγόμενα συγκυρήσει,
Καὶ πάλιν ἀφανίζεται τὸ δεύτερον καὶ θνήσκει.
Καὶ μετὰ διακόσια δις εἴκοσι τὰ ἔτη,
Ἐφ' Ἡρόδοτε γέγονε, καὶ πάλιν ἀνεφάνη,
Ὡς περ φησὶν Ἡρόδοτος.

Hist. Chiliad. ii. c. 50.

not as certainty, but probability and conjecture. My design hath been to ascertain, as far as may be, the *true rise and progress of astronomy among the antients*, by clearing its history from *fable and mythology*. This hath been the subject of some former letters to your lordship's worthy predecessor in the chair: And as the present enquiry makes part of the same (76) plan, it could be addressed to no one so properly as to your lordship; and, at the same time, it gives me an opportunity of expressing with what esteem I am,

MY LORD,

Your lordship's most obedient

and most devoted humble servant,

October 20, 1753.

G. Coflard.

LX. *An additional Remark to one of Mr. William Watson, F. R. S. in his Account of the Abbé Nolle's Letter concerning Electricity. By Thomas Birch, D. D. Secr. R. S.*

Read Jan. 10, 1754. **M**R. Watson, in a note upon his account of the ninth letter of the abbé Nolle concerning electricity, read before this

(76) See *Letter to M. Folkes, Esq; P. R. S.* p. 86.